

Surprise Payload Rack: A User Scenario of a Conceptual Novelty Intervention System for Isolated Crews on Extended Space Exploration Missions

Regina PELDSZUS^{a,1}

^a*Design Research Centre/ Astronautics & Space Systems Group, Kingston University London*

Abstract. Future space exploration missions to Near Earth Asteroids or Mars present unprecedented psychological challenges to the crew. One of these sets of factors includes long stretches of low workload, environmental monotony and confinement particularly during transfer phases of the trip. In previous orbital space missions, instances of isolation and monotony were remedied by audio or visual contact to ground, resupply of fresh cargo and visiting crews that provided diversion, variety and surprise. These powerful mitigation strategies will not be feasible in the autonomous setting of a deep space exploration mission. How can novelty be designed into a remote, virtually closed habitation system? Drawing on the historical experience of psychological support and countermeasures from orbital space missions and a series of related design studies, this paper addresses the need for the integration of variety as part of in-flight provisions. It describes the concept of a personalized 'surprise payload rack' (SPR) in the format of a fictional instruction manual, and discusses related R&D directions and organisational implications at the interface of non-invasive behavioural monitoring and smart, responsive vehicle environments.

Keywords. Human Space Exploration, Mars Mission Transfer, Habitats, Human Factors, Isolation, Monotony, Surprise, Vehicle Interaction, Autonomy

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¹ Corresponding Author: regina@spaceflightdesign.org

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